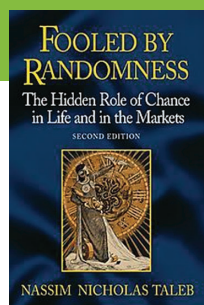


Book Extract



Fooled By Randomness
by Nassim Nicholas Taleb
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Fooled by Randomness

The nature of probability is easily misunderstood, and misinterpretations of statistics abound

A journalist is trained in methods to express himself rather than to plumb the depth of things - the selection process favors the most communicative, not necessarily the most knowledgeable. My medical doctor friends claim that many medical journalists do not understand anything about medicine and biology, often making mistakes of a very basic nature. I cannot confirm such statements, being myself a mere amateur (though at times a voracious reader) in medical research, but I have noticed that they almost always misunderstand the probabilities used in medical research announcements. The most common one concerns the interpretation of evidence. They most commonly get mixed up between absence of evidence and evidence of absence, a similar problem to the one we saw in Chapter 9. How? Say I test some chemotherapy, for instance Fluorouracil, for upper respiratory tract cancer, and find that it is better than a placebo, but only marginally so; that (in addition to other modalities) it improves survival from 21 per 100 to 24 per 100. Given my sample size, I may not be confident that the additional 3% survival points come from the medicine; it could be merely attributable to randomness. I would write a paper outlining my results and saying that there is no evidence of improved survival (as yet) from such medicine, and that further research would be needed. A medical journalist would pick it up and claim that one professor N.N. Taleb found evidence that Fluorouracil does not help, which is entirely opposite to my intentions. Some naïve doctor in Smalltown, even more uncomfortable with probabilities than the most untrained journalist, would pick it up and build a mental block against the medication, even when some researcher finally finds fresh evidence that such medicine confers a clear survival advantage.

CNBC at lunchtime

The advent of the financial television channel CNBC presented plenty of benefits to the financial community but it also allowed a collection of extrovert practitioners long on theories to voice them in a few minutes of television time. One often sees respectable people making ludicrous (but smart-sounding) statements that blatantly violate the laws of probability. One summer during which I was assiduous at the health club, I often heard statements such as “the real market is only 10% off the highs while the average stock is close to 40% off its highs,” which is intended to be indicative of deep troubles or anomalies - some harbinger of bear markets.

There is no incompatibility between the fact that the average

stock is down 40% from the highs while the average of all stocks (that is, the market) is down 10% from its own highs. One must consider that the stocks did not all reach their highs at the same time.

Given that stocks are not 100% correlated, stock A might reach its maximum in January, stock B might reach its maximum in April, but the average of the two stocks A and B might reach its maximum at some time in February. Furthermore, in the event of negatively correlated stocks, if stock A is at its maximum when stock B is at its minimum, then they could both be down 40% from their maximum when the stock market is at its highs! By a law of probability called distribution of the maximum of random variables, the maximum of an average is necessarily less volatile than the average maximum.

You should be dead by now

This brings to mind another common violation of probability by prime-time TV financial experts, who may be selected for their looks, their charisma, and their presentation skills, but certainly not for their incisive minds. For instance, a fallacy that I saw commonly made by a prominent TV financial guru goes as follows: “The average American is expected to live seventy-three years. Therefore if you are sixty-eight you can expect to live five more years, and should plan accordingly.” She went into precise prescriptions of how the person should invest for a five-more-years horizon. Now what if you are eighty? Is your life expectancy minus seven years? What these journalists confuse is the unconditional and conditional

“The selection process of journalists favors the most communicative, not necessarily the most knowledgeable”

life expectancy. At birth, your unconditional life expectancy may be seventy-three years. But as you advance in age and do not die, your life expectancy increases along with your life. Why? Because other people, by dying, have taken your spot in the statistics, for expectation means average. So if you are seventy-three and are in good health, you may still have, say, nine years in expectation. But the expectation would change, and at eighty-two, you will have another five years, provided of course you are still alive. Even someone one hundred years old still has a positive conditional life expectation. Such a statement, when one thinks about it, is not

too different from the one that says: Our operation has a mortality rate of 1%. So far we have operated on ninety-nine patients with great success; you are our one hundredth, hence you have a 100% probability of dying on the table.

TV financial planners may confuse a few people. This is quite harmless. What is far more worrying is the supply of information by nonprofessionals to professional; it is to the journalists that we turn next.

The Bloomberg explanations

I have, on my desk, a machine eponymously called a Bloomberg (after the legendary founder Michael Bloomberg). It acts as a safe e-mail service, a news service, a historical-data retrieving tool, a charting system, an invaluable analytical aid, and, not least, a screen where I can see the price of securities and currencies. I have gotten so addicted to it that I cannot operate without it, as I would otherwise feel cut off from the rest of the world. I use it to get in contact with my friends, confirm appointments, and solve some of those entertaining quarrels that put some sharpness into life. Somehow, traders who do not have a Bloomberg address do not exist for us (they have to have recourse to the more plebeian Internet). But there is one aspect of Bloomberg I would dispense with: the journalist's commentary. Why? Because they engage in explaining things and perpetuate the right-column, left-column confusion in a serious manner. Bloomberg is not the sole perpetrator; it is just that I have not been exposed to newspapers' business sections over the past decade, preferring to read real prose instead.

As I am writing these lines I see the following headlines on my Bloomberg:

- Dow is up 1.03 on lower interest rates
- Dollar down 0.12 yen on higher Japanese surplus

and so on for an entire page. If I translate it well, the journalist claims to provide an explanation for something that amounts to perfect noise. A move of 1.03 with the Dow at 11,000 constitutes less than a 0.01% move. Such a move does not warrant an explanation. There is nothing there that an honest person can try to explain; there are not reasons to adduce. But like apprentice professors of comparative literature, journalists being paid to provide explanations will gladly and readily provide them. The only solution is for Michael Bloomberg to stop paying his journalists for providing commentary.

Significance: How did I decide that it was perfect noises? Take a simple analogy. If you engage in a mountain bicycle race with a friend across Siberia and, a month later, beat him by one single second, you clearly cannot quite boast that you are faster than him. You might have been helped by something, or it can be just plain randomness, nothing else. That second is not in itself significant enough for someone to draw conclusions. I would not write in my

pre-bedtime diary: Cyclist A is better than cyclist B because he is fed with spinach whereas cyclist B has a diet rich in tofu. The reason I am making this inference is because he beat him by 1.3 seconds in a 3,000 mile race. Should the difference be one week, then I could start analyzing whether tofu is the reason, or if there are other factors.

Causality: There is another problem; even assuming statistical significance, one has to accept a cause and effect, meaning that the event in the market can be linked to the cause proffered. Post hoc ergo propter hoc (it is the consequence because it came after). Say hospital A delivered 52% boys and hospital B delivered the same year only 48%; would you try to give the explanation that you had a boy because it was delivered in hospital A?

Causality can be very complex. It is very difficult to isolate a single cause when there are plenty around. This is called multivariate analysis. For instance, if the stock market can react to U.S. domestic interest rates, the dollar against the yen, the dollar against the European currencies, the European stock markets, the United States balance of payments, United States inflation, and another dozen prime factors, then the journalists need to look at all of these factors, look at their historical effect both in isolation and jointly, look at the stability of such influence, then, after consulting the test statistic, isolate the factor if it is possible to do so.

Finally, a proper confidence level needs to be given to the factor itself; if it is less than 90%.

The story would be dead. I can understand why Hume was extremely obsessed with causality and could not accept such inference anywhere.

I have a trick to know if something real in the world is taking place. I have set up my Bloomberg monitor to display the price and percentage change of all relevant prices in the world: currencies, stock, interest rates, and commodities. By dint of looking at the same setup for years, as I keep the currencies in the upper left corner and the various stock markets on the right, I managed to build an instinctive way of knowing if something serious is going on.

The trick is to look only at the large percentage changes. Unless something moves by more than its usual daily percentage change, the event is deemed to be noise. Percentage moves are the size of the headlines. In addition, the interpretation is not linear; a 2% move is not twice as significant an event as 1%, it is rather like four to ten times. A 7% move can be several billion times more relevant than a 1% move! The headline of the Dow moving by 1.3 points on my screen today has less than one billionth of the significance of the serious 7% drop of October 1997. People might ask me: Why do I want everybody to learn some statistics? The answer is that too many people read explanations. We cannot instinctively understand the nonlinear aspect of probability .

